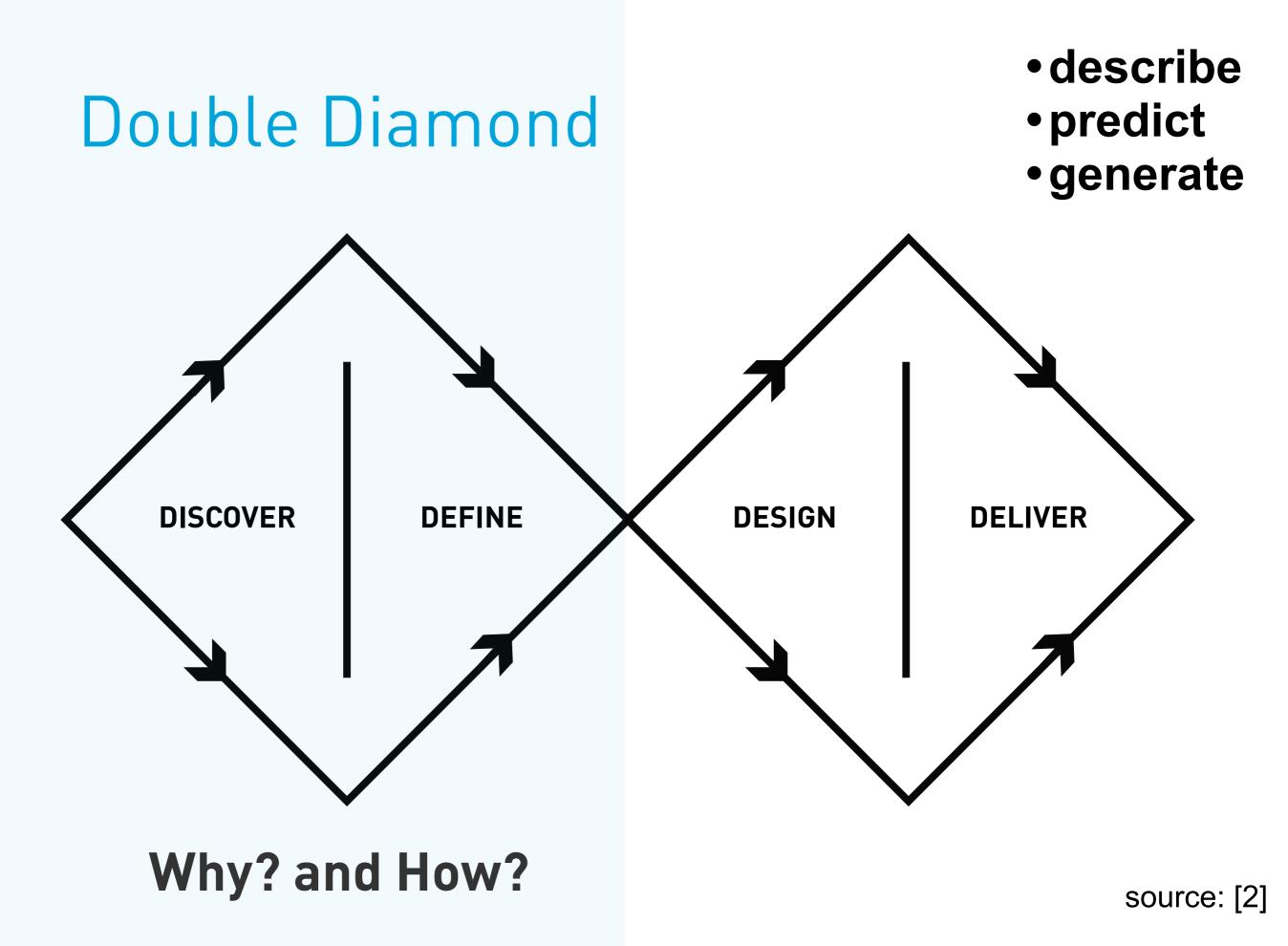
### Interaction Design

Chapter 6 (June 7th, 2018, 9am-12pm): Laws of Interaction Design

## Why laws? What for?

- We will learn laws about:
- computers
- human motor skills
- human cognition
- There are 3 good reasons for laws in ID:
- describe: understand what is going on
- predict what will happen if...
- generate new alternatives



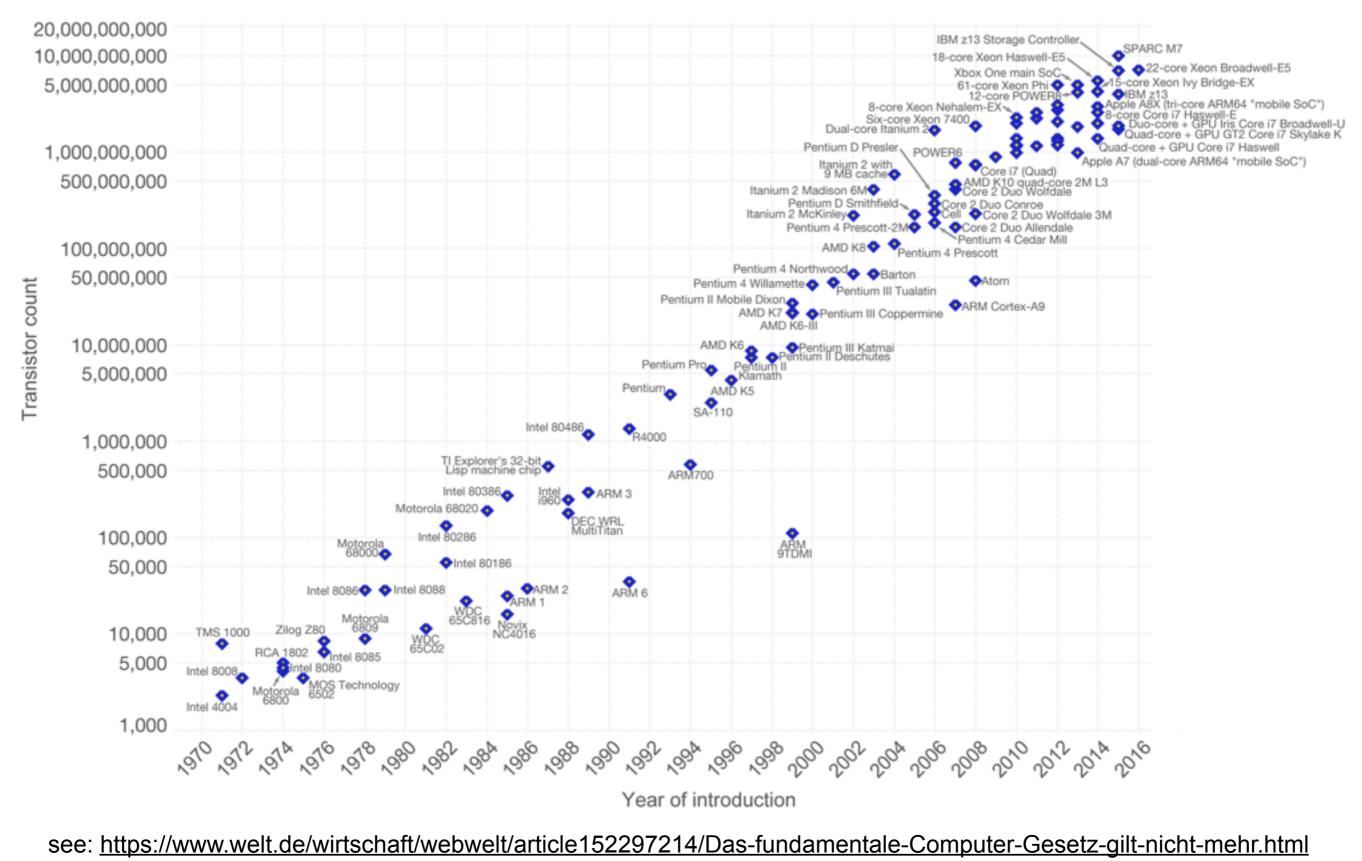
- Moore's law
- Buxton's law
- Fitts' law
- Steering law
- Guiard's Kinematic chain model
- Hick's law
- Law of practice
- Murphy's law

## Moore's law

"The complexity for minimum component costs has increased at a rate of roughly a factor of two per **year**...Certainly over the short term this rate can be expected to continue, if not to increase. Over the longer term, the rate of increase is a bit more uncertain, although there is no reason to believe it will not remain nearly constant for at least 10 years. That means by 1975, the number of components per integrated circuit for minimum cost will be 65,000. I believe that such a large circuit can be built on a single wafer."

[Moore, Gordon E. "Cramming more components onto integrated circuits". Electronics, Volume 38, Number 8, April 19, 1965.]

## Moore's law illustration



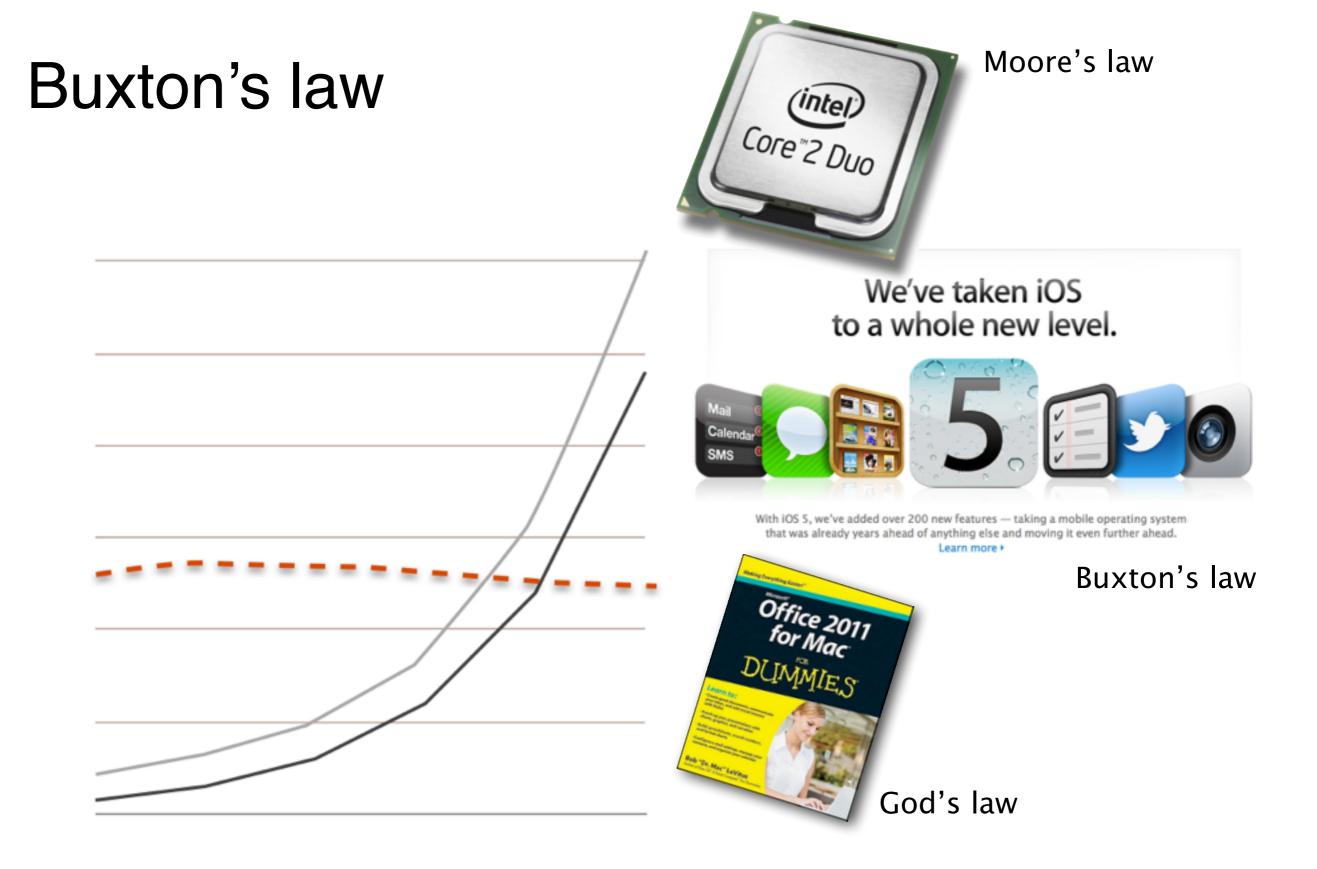
LMU München – Medieninformatik – Alexander Wiethoff + Andreas Butz – User Experience Design 1 – SS2018

## Moore's law implications

Don't worry too much about:

- computing power
- storage capacity
- screen resolution
- device size
- weight
- battery life (?)

- Moore's law
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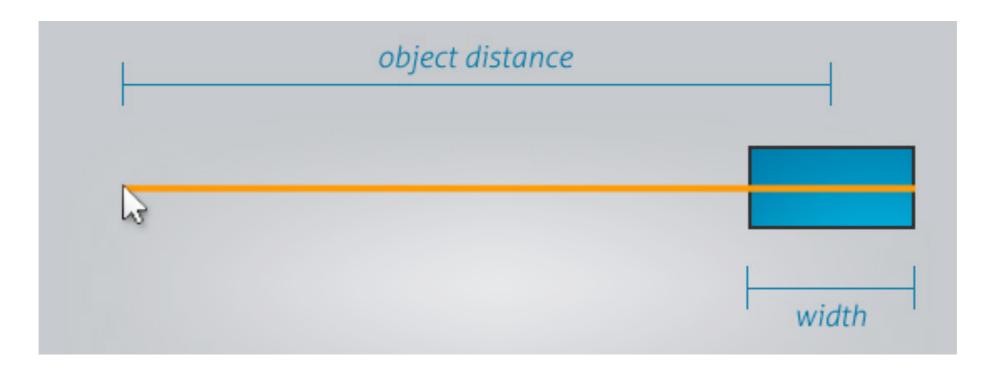


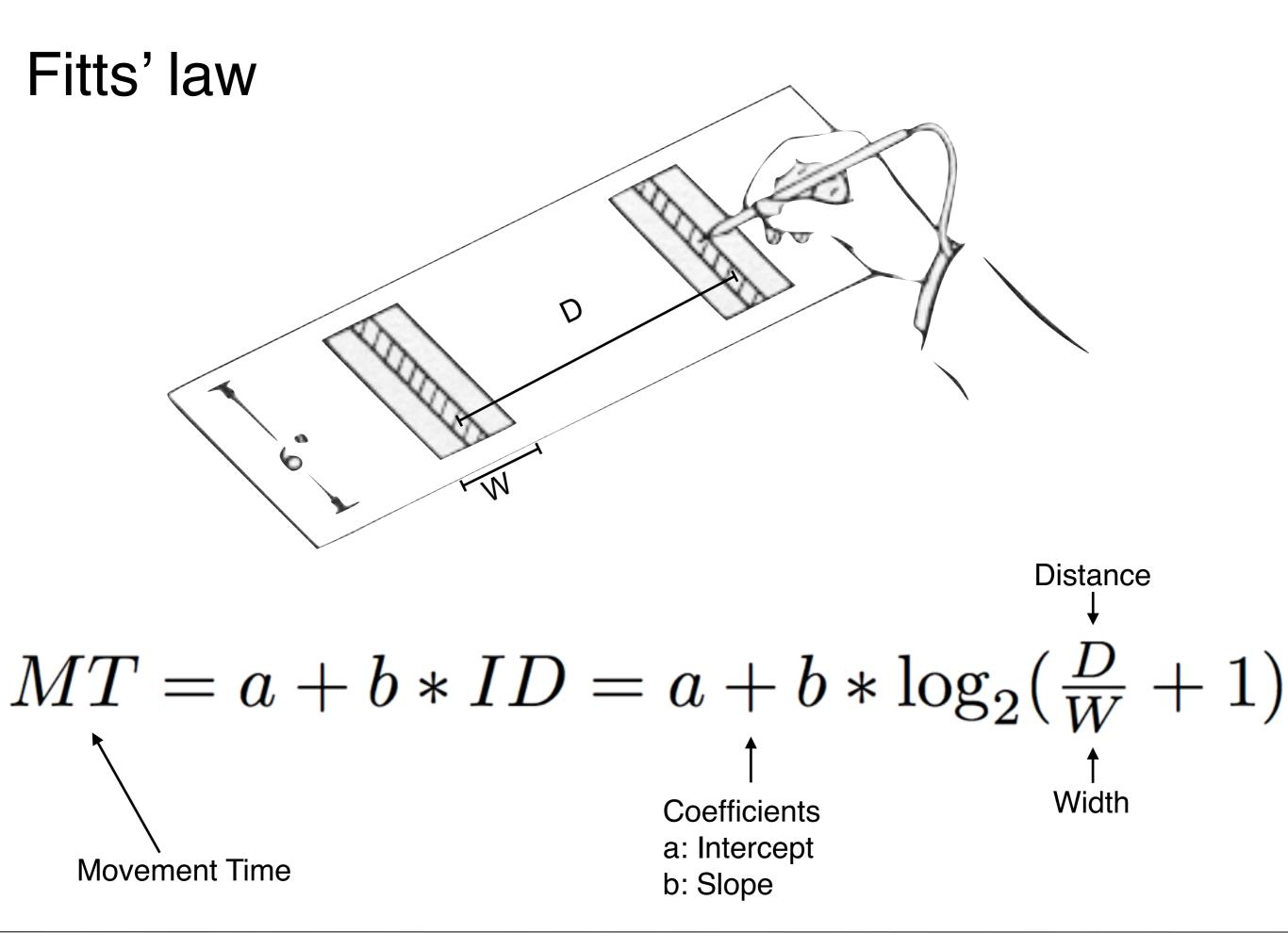
#### http://www.billbuxton.com/LessIsMore.pdf

- Moore's law
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## Fitts' law

# The time to acquire a target is a function of the distance to and width of the target.





## Speed-accuracy tradeoff:



Illustration from http://particletree.com/features/visualizing-fittss-law/

## Implications of Fitts' law

Larger targets are easier to hit -> maximize button size

List of Invoice
Archive Delete Copy Print Send Enter Payment Pay Online
Invoice Client Name Description Date

Movement time increases (logarithmically) with distance -> minimize distances -> no movement is even better!

Infinite Target Widths at Edges

Infinite targets:

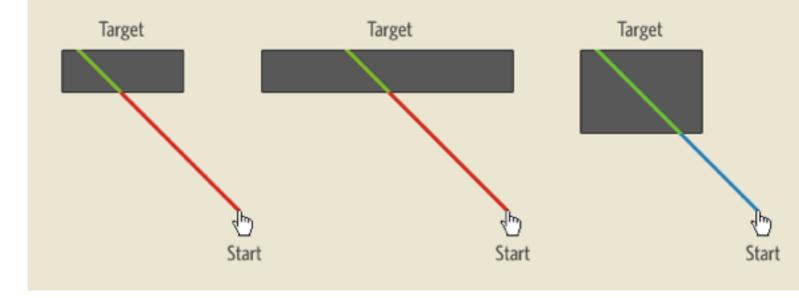
-> leverage screen borders

-> leverage corners

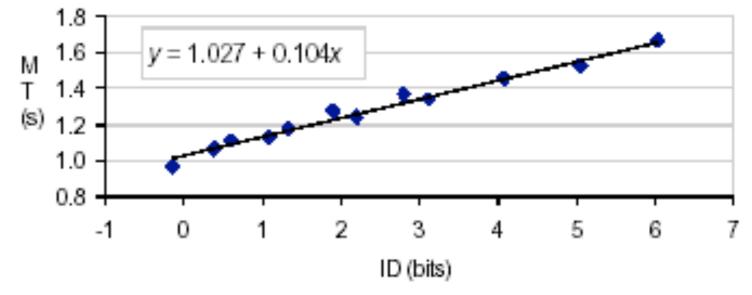
Illustration from <a href="http://particletree.com/features/visualizing-fittss-law/">http://particletree.com/features/visualizing-fittss-law/</a>

## **Bigger Is Not Always Better**

#### Movement direction to target



Logarithmic improvements with size



MacKenzies reevaluation of Card's Fitts' Experiment for text selection

# Stu Card A Supporting Science

Interview March 2002

### The Mouse and the Desktop

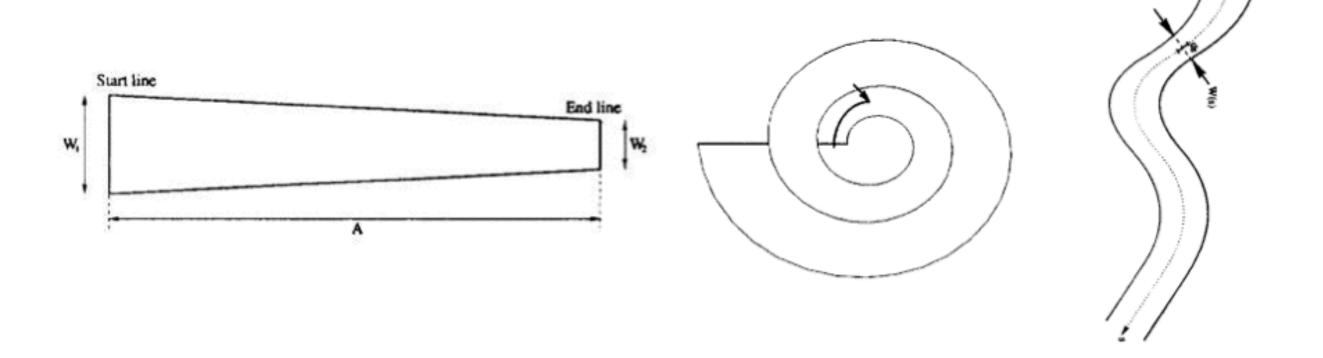




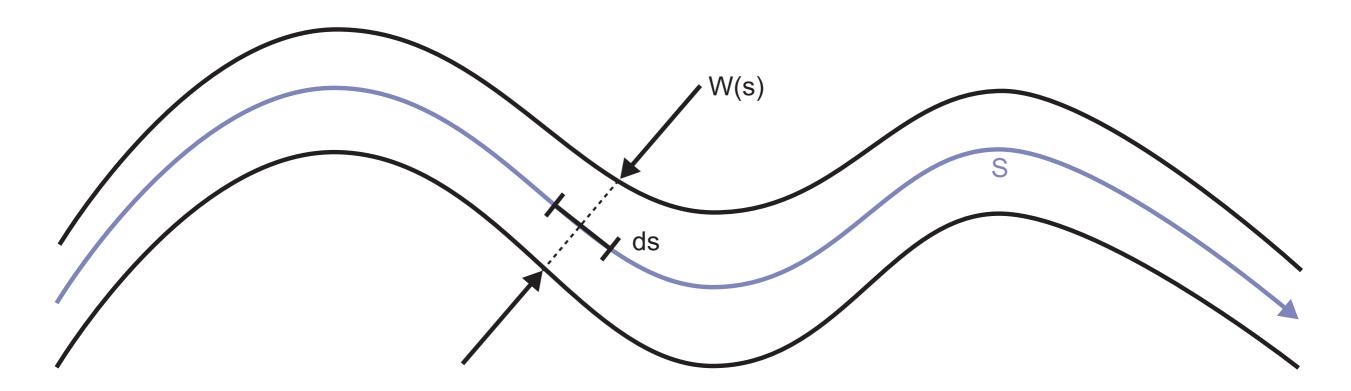
- Moore's law
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## Why is it called Steering Law??

- Early work focused on car driving scenarios and models with straight tunnels
- · Various example tunnel shapes have been explored



## Steering law on curved paths

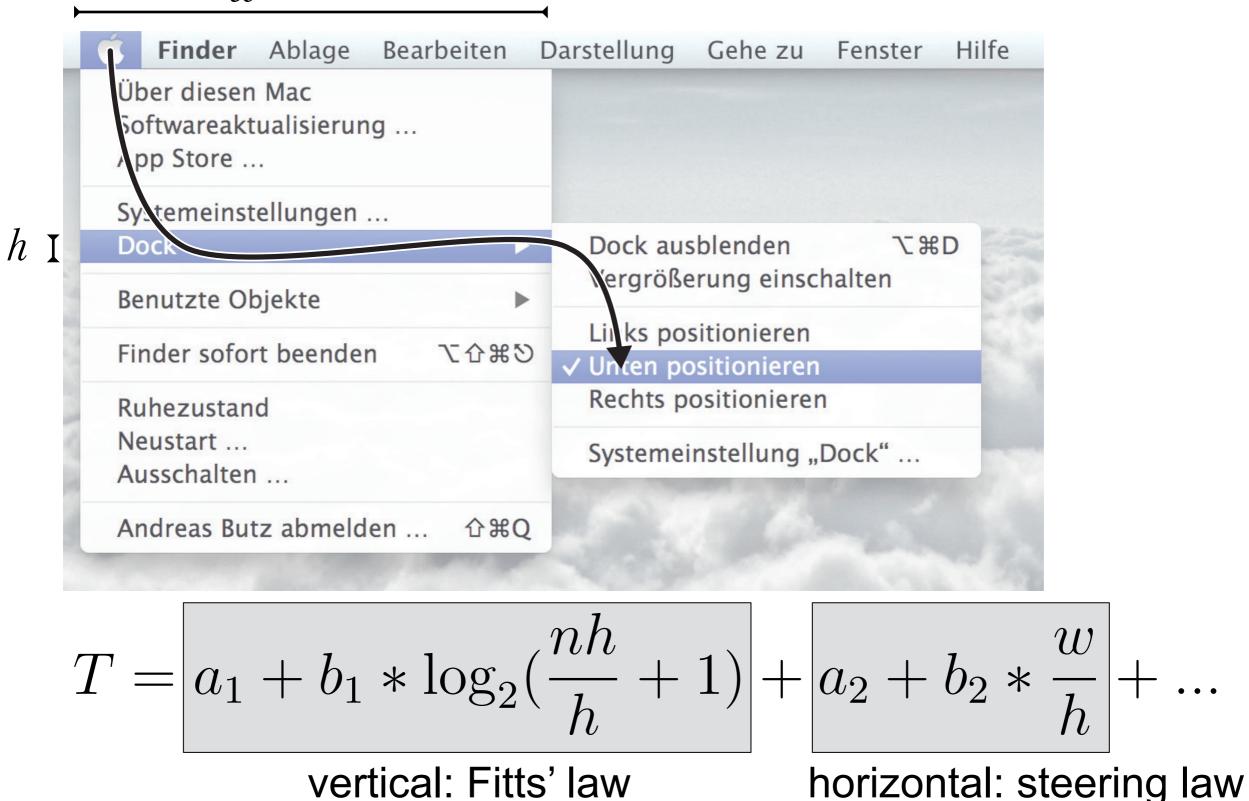


average time to navigate through the path

$$\begin{array}{c} \downarrow \\ T = a + b * \int \frac{1}{W(s)} \mathrm{d}s \\ \uparrow & \uparrow & S \\ \end{array}$$
experimentally fitted constants

## Example application of the steering law

 $\mathcal{W}$ 

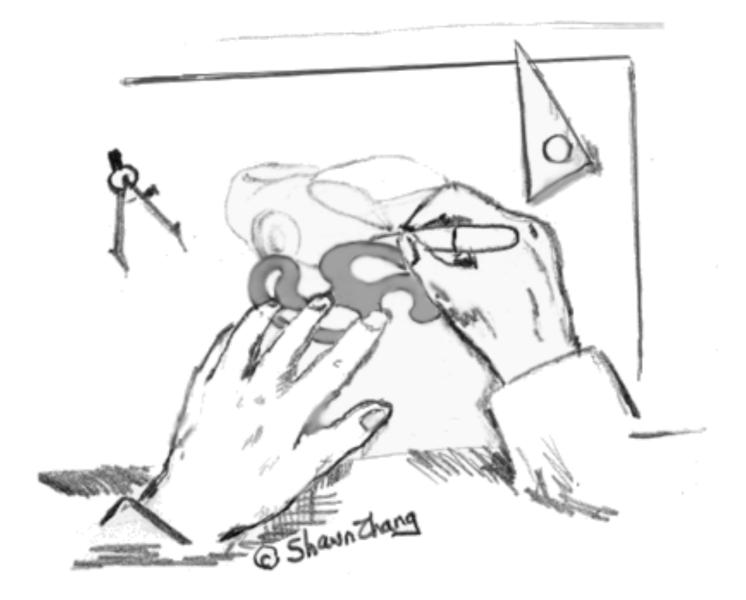


## Mini-discussion

## How can we use Fitts' law and the steering law to make a computer game more challenging?

- Moore's law
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## Two-handed motor tasks: a human capability



From The Two-Handed Desktop Interface: Are We There Yet? [MacKenzie & Guiard, 2001]

## Guiard's Kinematic Chain

"Under standard conditions, the spontaneous writing speed of adults is **reduced** by some **20%** when instructions **prevent the non-preferred hand** from manipulating the page"

Non-dominant hand provides a frame of reference for the dominant hand

- Non-dominant hand operates at a coarse temporal and spatial scale;
- Dominant hand operates at a fine temporal and spatial scale

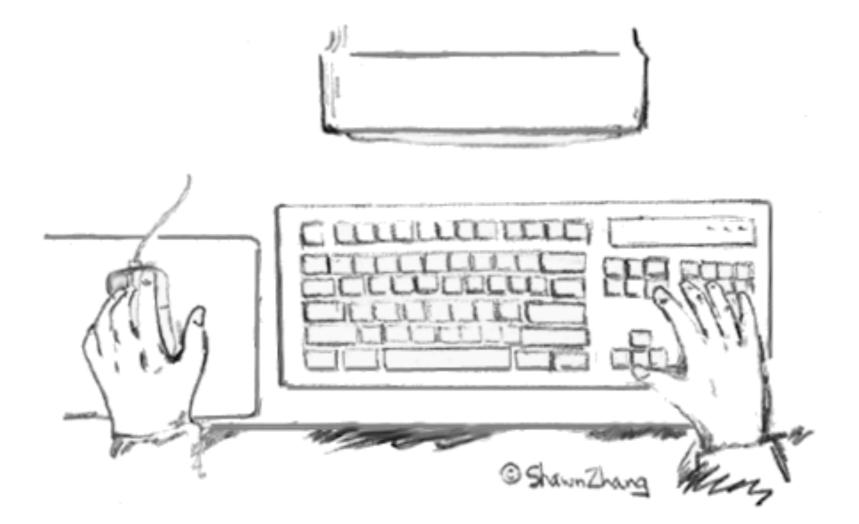
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## Two handed-interaction at the desktop



From The Two-Handed Desktop Interface: Are We There Yet? [MacKenzie & Guiard, 2001]

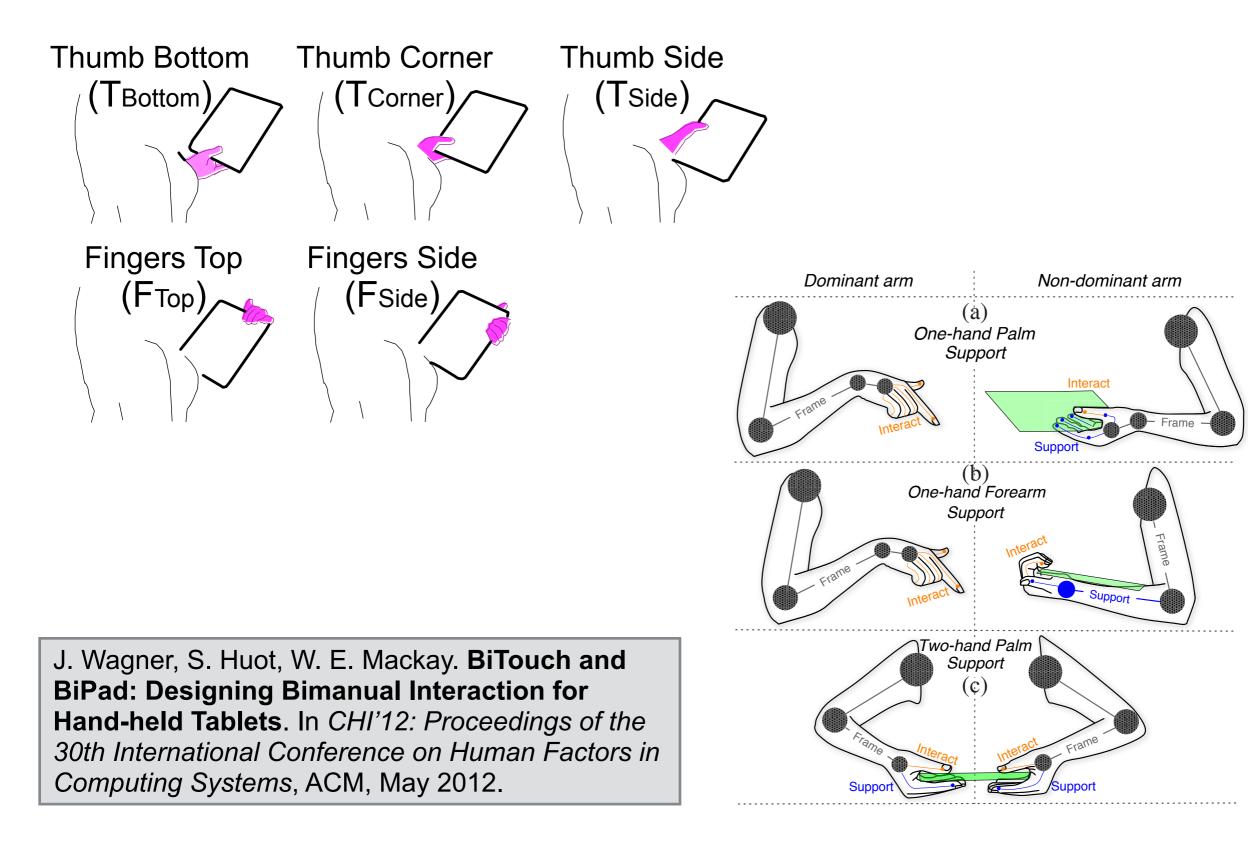
# Which tasks in daily life follow a similar distribution of roles between the hands?

Which ones don't ???



http://www.lobshots.com/wp-content/uploads/2011/08/lobster\_560x375.jpg

## Application - how do people hold tablets?



## Tangible Two-handed Interaction: Example

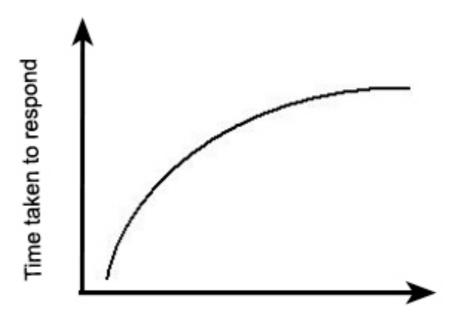


Hilliges, Otmar, Dominikus Baur und Andreas Butz: Photohelix: Browsing, Sorting and Sharing Digital Photo Collections. In: Proceedings of IEEE Tabletop, pp 87–94. IEEE Computer Society, 2007.

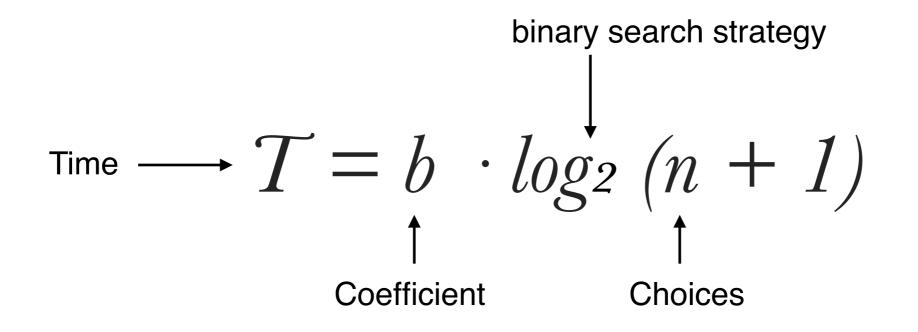
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## Hick's law

Given **n** known and **equally probable** choices, the average reaction **time** *T* required **to choose among them** is:



Number of alternative stimuli



## Hick's Law Examples (really? let's discuss!)

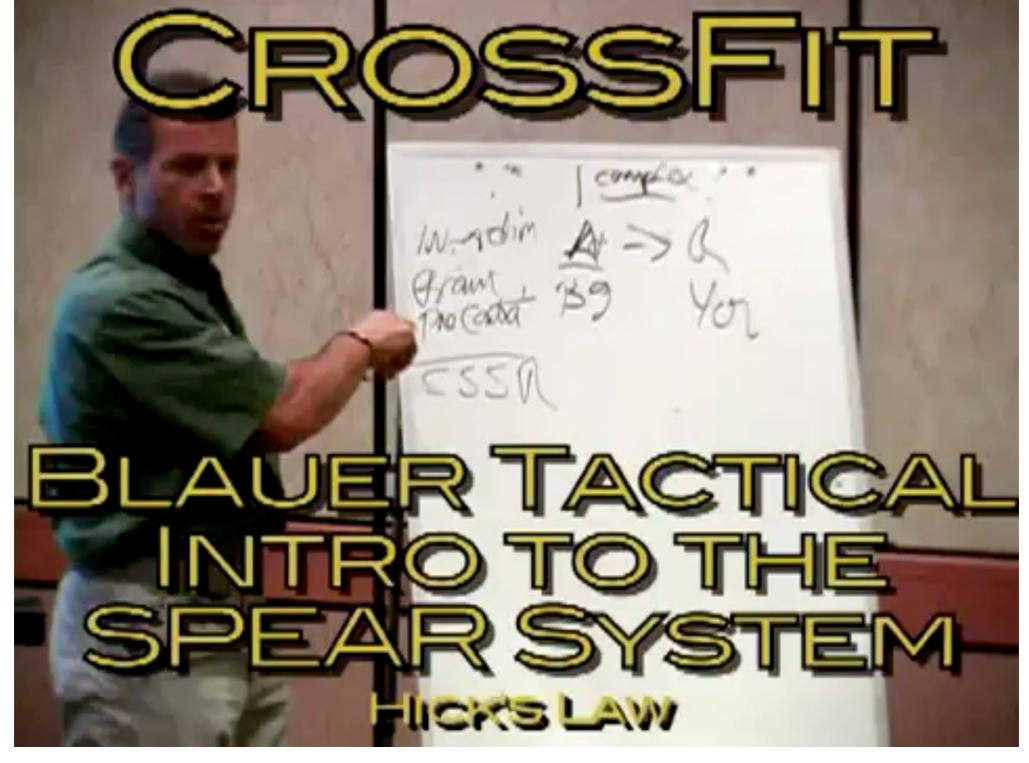
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In another context, and slightly wrong ;-)...

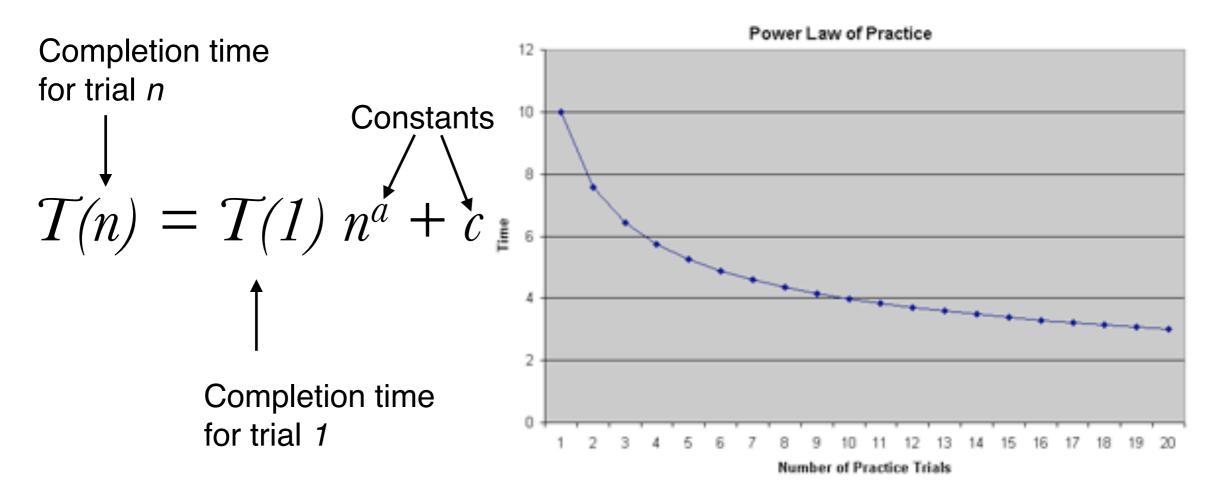


https://www.youtube.com/watch?v=w0hJveJ8Hp0

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## The Power Law of Practice

- When performing a task based on practice trials, people improve in speed at a decaying exponential rate.
- The time needed for a particular task decreases in proportion to the number of practice trials taken raised to a power of about a = -0.4
- The logarithm of the time needed for a particular task decreases linearly with the logarithm of the number of practice trials taken (this formulation is for the math geeks...;-)



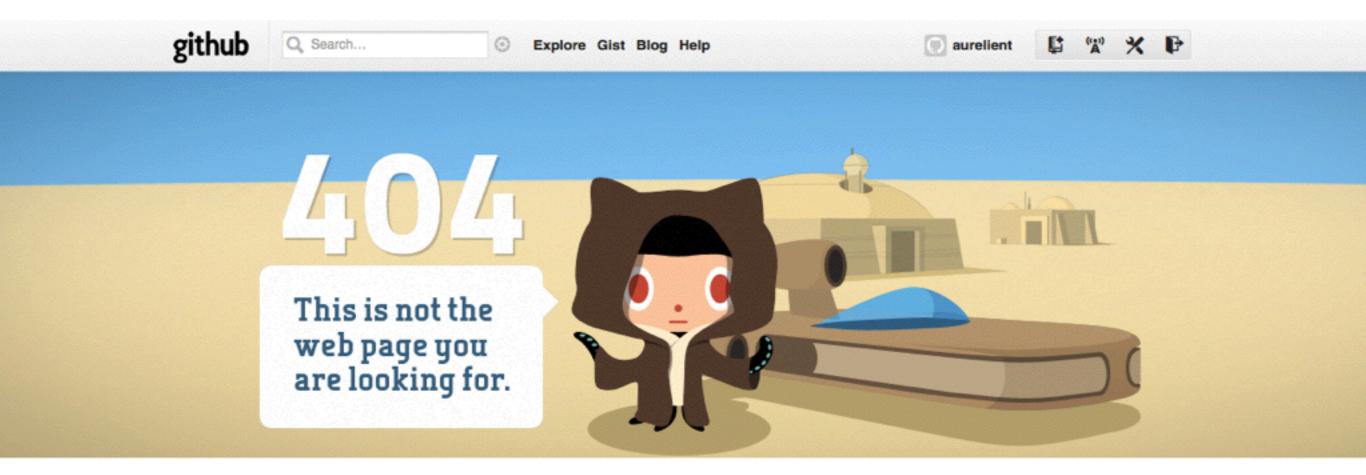
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### "Whatever can go wrong, will go wrong." [Edward Aloysius Murphy Jr., 1949]

"If there's more than one possible outcome of a job or task, and one of those outcomes will result in disaster or an undesirable consequence, then somebody will do it that way."

## Implications of Murphy's law

- Prepare for human errors, wrong input etc.
  - do sanity checks in dialogs
  - provide useful defaults
  - make serious mistakes hard
- When building stuff, provide extra time for:
  - mistakes in manufacturing
  - non-functioning tools
  - faulty material
  - misunderstandings





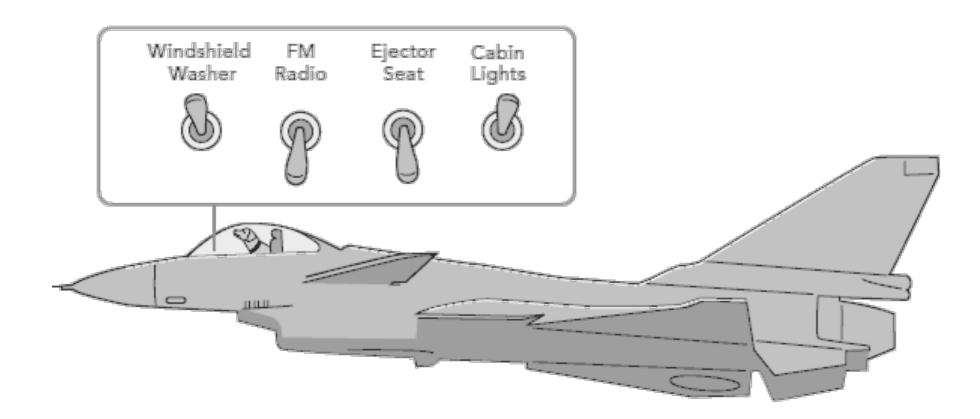


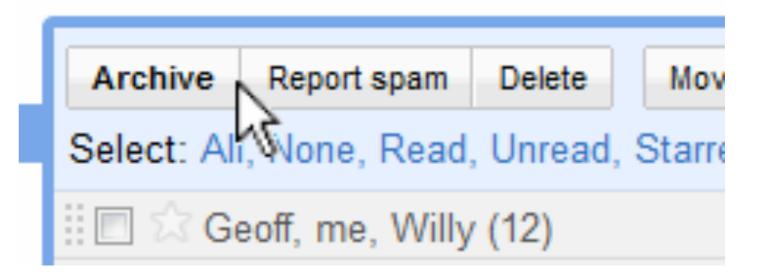
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## Murphy's vs. Fitts' law





## Murphy's law is still reality!



#### http://www.bergsteigen.com/news/toedlicher-unfall-wegen-falsch-montierter-express

## What have we learned today?

